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## CLINICAL MEMORANDA.

S. C. AYRES, M. D., CINCINNATI.

### INCRUSTATION OF LIME ON THE CORNEA.

A boy three years of age met with an accident by which the lower half of the cornea became thickly covered with a coat of lime. I first saw him about six weeks after the accident. There was then great photophobia and lachrymation, and the child suffered especially in the earlier part of the day. For a short time I endeavored with atropine and warm fomentations to reduce the inflammation, but the mechanical irritation produced by the crust resisted all palliative measures. It soon became evident that nothing but the removal of the deposit would give relief. The upper half of the cornea was perfectly clear, but the lower half presented a uniform rough white coat. The operation was performed in the following manner: After complete anæsthesia was produced, I passed a Graefe's cataract knife under the upper edge of the deposit (taking great care that its point should not penetrate too deep) and pushed it as far along as I could, and then cut out. This left a flap of the incrustation as broad as the knife blade. With a pair of fine forceps I seized the edge of the flap, and holding it tense sliced off as much as I could safely. I then pierced the crust again and cut out, and again removed a small piece. In this manner I went over the

entire area of the deposit to the conjunctival edge removing the crust and leaving the cornea clear. Castor oil and atropine were now used three or four times a day. It was not long before there was a marked improvement in the photophobia, and in three or four weeks it disappeared entirely. The epithelium was reprodduced, and the lower half of the cornea again presented a transparent appearance.

### Morgagnian Cataract — Successful Extraction by a Liebreich's Incision.

Mrs. T. A. R., 39, a small, delicate, pale-faced woman has been blind for ten years. In the right eye there is a characteristic Morgagnian cataract. The nucleus is unusually small and moves about freely in the capsule. The pupil responds promptly to light and projection and perception are excellent.

The left eye was operated on fourteen years ago, but by what method is not known. The operation was followed by suppuration and shrinking of the globe.

I wanted if possible to do the operation without an iridectomy and decided to make a Liebreich's incision. I made the incision purposely rather short, for it was quite evident that the nucleus was small. As soon as the capsule was ruptured its fluid contents escaped, and the nucleus was seen under the cornea with its upper edge just below the incision. The upper flap of the cornea was then depressed sufficiently to make the wound gap slightly when slight pressure on the lower flap caused the nucleus to slide out, leaving a perfectly clean black circular pupil. Cold water dressings were applied for twenty-four hours and then a dry bandage. Not the slightest reaction followed. In ten days her vision was $\frac{1}{3}$ and she could read Sn No. 2.

### Value of an Iridectomy in Leucoma Adhaerens.

Mrs. R., 32, had granular conjunctivitis in a very violent form, and during its progress there was ulceration and perforation of both corneæ upward. After the inflammation had subsided, she had fair vision with the left eye—could see to work and read, and it was deemed advisable to let the eye alone. With her right eye she had but little vision, and for fear it should become glaucomatous Dr. Williams decided to make an iridectomy

downward. There was at the time, 1865, no increased tension, but he feared that it might develop in the future.

At the present date, 1881, (sixteen years since the above statement of her condition) there is a very interesting and instructive state of affairs. The left eye, which then was the best, and, as she supposed, her only eye, is now hopelessly blind from secondary glaucoma. It came on slowly a few years ago unattended by pain, her only warning being her gradually failing sight.

Her right eye, which had been operated on, improved in vision, and she was forced to depend on it as the other one failed. The iridectomy had accomplished all that was expected and even more. It had prevented the development of glaucoma, and had saved her a useful amount of vision. The tension of the eye was normal and media clear, and there is every reason to think that she may retain all she now has.

### Leucoma Adhaerens.—Secondary Glaucoma—Iridectomy—Temporary Relief Followed by Glaucoma, which was Relieved by a Second Iridectomy.

J. L., 19, had an attack of acute granular conjunctivitis of a severe type, which was quickly followed by ulceration and perforation of the left cornea. The perforation occurred almost directly upward and was followed by a prolapse of the iris. When first seen, the eye presented the following appearance: The lids were granulated but not much thickened. From the upper part of the cornea protruded a *myocephalon* of about three mm. in diameter. It protruded considerably from the surface of the cornea. The iris was drawn up into the perforation and the pupil presented a pear-shaped appearance. The tension of the ball was slightly increased. The eye was sensitive to pressure, and eversion of the upper lid painful. The prolapse was snipped off close to the cornea and a pressure bandage applied. The iris could not be drawn out, as it was firmly agglutinated to the edge of the perforation. A firm cicatrix now formed, and for a while the eye did well and the treatment of the lids was continued. In about four weeks the tension of the eye was considerably above normal, and he suffered pain almost constantly. As eserine gave only temporary relief, it was determined to make

an iridectomy. It was accordingly done on the nasal side of the perforation. This relieved the glaucomatous tendency entirely, and he soon went home, both eyes being in a fair condition. In four months he returned stating that the left eye had again become hard and painful. The tension was + 2. There seemed to be only one thing to do, and that, to make another iridectomy. It was done on the temporal side of the scar thus freeing the imprisoned iris completely. It is now more than two years since the last operation, and there has been no return of glaucoma. He enjoys moderately good vision with the eye as the cornea was fortunately not opaque.

### True Diphtheritic Conjunctivitis.

A child five months old was brought for advice as to the left eye which the mother said had been sore for eight days. It had been poulticed but no other treatment had been ordered. The lids were immensely swollen, and presented a peculiar lippy appearance, and their edges were bathed in thick pus. They were very hard and unyielding, and I could not press the palpebral fissure open. After the pus had been carefully removed, that peculiar pale yellowish gray color of the edge of the conjunctiva, so characteristic of this fatal disease, could be seen. This is due to fibrinous infiltration of the conjunctiva causing a compression of the blood vessels and interference with the circulation, and is quite in contrast with the vividly injected and florid appearance we see in croupous conjunctivitis or in ordinary purulent inflammation. The poultices were discontinued, and the mother was directed to wash the eye off frequently with tepid water and to dust iodoform on the edges of the lids. An unfavorable prognosis was given. In three days the lids had so far softened as to enable me to open them sufficiently to show that the cornea was completely destroyed. The fellow eye was not affected.

### Pyramidal Cataract, Followed by Complete Cataract.—Successful Extraction of One of the Lenses.

Mamie Conover, 14 (July, '84), has shrunken opaque lenses in both eyes. She still sees to go around, but is at present an inmate of the Blind Asylum at Columbus. The lenses appear very white and chalky. In the center of each lens is a cone or pyra-

mid which is congenital, and from the base of the cones to the periphery of the lenses the capsule presents a wrinkled or corrugated appearance. When three years old an iridectomy inward was made in each eye to improve her vision, the periphery of the lenses being then perfectly transparent. This gave her good sight until three or four years ago when the cataracts began to develop. It was decided to extract the right lens, and under anaesthesia I made the ordinary Graefe's incision upward. I discised the capsule, but could not sweep the cystotome very far around on account of the projecting cone. As the capsule was thickened and opaque, I wanted to remove it with the cone so as to give her a clear pupil. She was very restless under the anæsthetic, and I felt afraid to remove the cone with forceps in advance of the removal of the lens, as the latter was rather small and shrunken, and might be easily dislocated. Slight pressure from below brought the lens out entire, but left the pyramid *in situ* attached by the lower portion of the capsule. The pupil around the pyramid, where the capsule had been discised, was perfectly clear and black. Cold water was applied for a day and then a dry bandage. There was no reaction whatever, and in ten days she was discharged. Her vision was considerably improved, but not enough to enable her to read large print. As this was the most imperfect of the two eyes, she may have a better result after the extraction of the left lens.

I append a report of the case as it was originally reported in the *Lancet and Observer*, Dec., 1874:

### Case of Pyramidal Cataract, not Following Ophthalmia Neonatorum—Double Iridectomy Inward—Excellent Visual Results.

Pyramidal cataract is generally described as one form of anterior capsular cataract. While it may be congenital, it is usually supposed to result from ulceration and perforation of the cornea, which takes place during the progress of ophthalmia neonatorum. After the perforation occurs, the lens naturally comes forward in close proximity to the cornea. Plastic lymph is thrown out from the walls of the ulcer, and a little nodule of this adheres to the center of the capsule of the lens, partly be-

cause the rest of the lens is protected by the iris, and partly because the ulcer is generally central and not peripheral. When the ulcer fills up sufficiently to retain the aqueous, and the anterior chamber becomes re-established, there remains on the cornea an opacity more or less extensive, depending on the size of the ulcer. In many cases this opacity disappears, not leaving a trace behind, while in others it remains permanently.

The changes which take place in the lens and its capsule are various. There may remain only a single opaque spot on the capsule, or there may be two or more white dots on it, while the balance of the lens remains perfectly clear. In rare cases we see a well-defined cone or pyramid projecting from the anterior surface of the lens into the aqueous. Occasionally, we observe that the deeper laminæ of the lens, around the central opacity, are opaque, while the margins of the lens are transparent.

This theory of the deposit of lymph upon the capsule has found an opponent in the person of that very close observer, Mr. Hutchinson, of the Royal London Ophthalmic Hospital. He advances the theory "that the mere proximity of inflammatory action on the surface of the conjunctiva and cornea suffices to disturb the nutrition of the lens capsule, and to produce deposits." This theory, to say the least, appears reasonable, and may account for many of the cases where no trace of opacity of the cornea remains. The fact that the convexity of the lens is, in the majority of cases, not at all perceptibly altered, would rather argue against the deposit of lymph on it.

One great difficulty is coming to any definite conclusion, in many of these cases, is that the early history is entirely wanting. There is no positive evidence of purulent ophthalmia in infancy, and yet we find pyramidal cataract present, and it is impossible to say whether there has or has not been ulceration and perforation of the cornea. It will only be by carefully observing the results in cases of purulent conjunctivitis that we will be able to decide the question satisfactorily.

M. C., æt. 3, a healthy, well-developed child, has pyramidal cataract in both eyes. She has never learned to walk, simply because she can not trust herself alone, and not because her limbs are not well-developed. She is the eighth child in the

family, and all the preceding ones are healthy and have sound eyes. From Dr. E. Jennings, Dayton, O. (who referred the case to us for treatment), we have learned that the child never had purulent conjunctivitis, or any inflammation of the eyes sufficient to attract his or the mother's attention. As he has had an opportunity to see the child occasionally from her birth up to the present time, we may consider the question of purulent ophthalmia settled, for it wonld not be likely to escape his careful observation. The defect in the child's eyes was not noticed until several weeks after she was born.

The eyeballs are full and well-developed, the corneæ perfectly clear, and the irides very active. The cones or pyramids which project from the central portion of the lenses seem to come forward almost to the posterior surface of the cornea. The bases of the cones fill the pupil as it appears at ordinary dilation. Around the base of each cone is a narrow ring of opacity in the lens, but beyond this it is perfectly transparent. The child sees best by holding objects to one side or the other; but her sight is very imperfect.

The question of treatment in the case was one of great importance. The safest and best plan was to be chosen, and this was decided to be an iridectomy inward. It was presumable that the fundus was sound from the fact that the child had only a very moderate degree of nystagmus. Discission was contra-indicated, because so much of the lens was transparent. Violent inflammation would most likely have followed such an operation, and the eye have been lost in consequence.

An iridectomy was indicated, first, because it was safest; and second, because if the lens should ultimately become opaque, it would not interfere with a subsequent discission or extraction.

Dr. Williams accordingly operated on both eyes, making an iridectomy inwards, as it was most likely to afford the best visual results in that direction. Very little irritation followed the operation, and in a short time the patient returned home.

In a letter received from Dr. Jennings about fourteen months afterward, he says: "I to-day availed myself of the first opportunity (since the receipt of your letter of inquiry) to visit your patient, Mamie Conover. I found her in great glee, running

about the room, picking up small bits of white cloth from the floor, and depositing them in a hole in a chair where a round had been removed. In examining any article closely, she brings the object quite near the eyes. My impression is that she sees best with the left eye, and is constantly improving."

One object in presenting this case was to show the excellent results following iridectomy. It is attended with little or no danger to the eye, and if the lens remains transparent, as it may, gives better visual results than could be expected from the operation of discission. The child is still quite young, and as she grows older will be able to control her eyes better.

The remarkable improvement in her vision was evinced by the fact that she soon learned to walk after the operation.

In this case there was satisfactory evidence that the child never had purulent ophthalmia nor any other inflammation of the eyes sufficiently severe to attract the attention of the mother. We are compelled, then, to abandon the theory of lymph deposit, and also that of the disturbance of the nutrition of the lens capsule from proximity of inflammatory action.

Are we not, then, forced to fall back upon the supposition that the development of these pyramidal cataracts was congenital?

# A THEORY OF THE MECHANISM OF ACCOMMODATION.

First written in July, 1885, in Pittsburgh, Pa.,

BY E. E. FURNEY, M. D.

The power of accommodation of the eye to different distances has caused much study and speculation, not alone for the pleasure of merely knowing by what process it is accomplished, but because so many diseases of the eye are so intimately connected with and first made manifest by a failure in it, that an exact knowledge of its methods will help to a more clear understanding of those diseases and the means for successfully treating them.

As none of the theories heretofore suggested have been found to accord with all the known facts, the true one remains to be discovered.

The facts arranged in the order of their bearing upon the subject, exhibit:

First, that all movements necessary for the purposes of accommodation are voluntary.

This fact is axiomatic, but is shown by the experiments of Helmholtz.

Second, that the crystalline lens is the independent variable refracting body subject to change for the purposes of accommodation.

This fact is conclusively proved and shown by the experiments of Cramer and Donders. A corollary to this is that the cornea, sclerotic and muscles of the orbit are unchanged and inactive during the interval of accommodation. The entire mechanism must therefore lie inside the outer tunic of the eye, and must act either directly or indirectly upon the lens.

Third, that the anterior segment of the lens is the only one subject to variation in its curvature for the purposes of accommodation. This is also shown by the experiments of Cramer and Donders. The anatomy of the eye also shows the neces-

sity of this condition. The posterior segment of the lens being supported in a matrix formed by the anterior portion of the vitreous body, while the anterior segment may be said to float in the aqueous humor, which can readily accommodate itself to a change in the shape of the lens.

These are known facts, as they have been abundantly proved. But by what process the lens is made to change the curvature of its anterior surface, has not hitherto been made clear.

Examining it as a purely mechanical problem, there appear but two ways possible, and it is one of these that has long been received as the correct one; but since it can be shown that it calls for movements that are known not to occur, it must manifestly be an error.

The method here referred to is the one in which the capsule of the lens is supposed to be varied in size, forcing the contents into a more or less spherical shape as its area is reduced by allowing it to contract upon itself, or its area is increased or extended by stretching.

This stretching and releasing is represented as being caused by the ciliary muscle which, having its origin in the sclerotic at the border of the cornea, radiates inward and backward and is inserted into the choroid and so indirectly acts upon the suspensory ligament.

That this arrangement might be made to modify the curvature of the lens there can be no doubt. For the muscle by contracting would draw the membrane and suspensory ligament forward, and this would allow the elastic capsule to contract about the lens; and the muscle being relaxed, the membrane by virtue of its elasticity would contract to its first dimensions, and draw upon the borders of the capsule, so as to modify the shape of the lens as before stated. But in doing so it would of necessity do more. The curvature of the cornea would also be affected, for by the contraction of the ciliary muscle the strain would be reduced upon the borders of the capsule of the lens it is true, but the strain upon the borders of the cornea would be increased by an equal amount, thus flattening the cornea, and by a relaxation of the ciliary muscle, opposite results would follow. But we know that the curvature of the cornea remains unchanged.

The pressure transmitted through lens and vitreous body onto the retina would vary with each change in the tension of the muscle and cause sensations that are known not to be present. Again, since the posterior segment of the lens is more convex than the anterior, a tension upon the borders of the capsule would tend to flatten that surface and to make the anterior surface more convex instead of less.

These things would seem to afford sufficient reason for the rejection of this theory, though additional reason seems to be afforded in the apparent ability of the other theory to meet these facts, though it may call for further investigation in microscopic anatomy before it can be fully accepted.

In this other theory the area of the capsule of the lens is assumed as the practical constant, and the contents or volume of the lens to be the important variable, and made so by the injection into or withdrawal from the intercellular spaces of a small quantity of a transparent liquid. The ciliary processes may serve as reservoirs of this liquid, or possess the power of quickly secreting it.

The contraction of their muscular coats or of the muscular coats of their arterial components, pressing the liquid out of these reservoirs into the lens, increasing its volume and thereby the convexity of its anterior segment, and projecting it forward into the space made vacant by the reduction in volume of the ciliary processes or cysts of an exactly equal amount. The greater flatness of the anterior surface causes that surface to present the lesser resistance and therefore to be the one pushed forward and rendered more convex.

In this way there is no strain transmitted to retina, sclerotic or cornea: every force is exactly balanced, and a most perfect mutual compensation is afforded for the change in volumes.

By a relaxation of the muscles the liquid would retreat from the lens into the reservoirs, again filling the space made vacant by the flattening of the lens.

Nourishment also would thus be afforded the lens at each accommodation for a near object from a far one. And by allowing too long an interval to elapse between such movements there may be a cause for disease, for which the remedy would be at

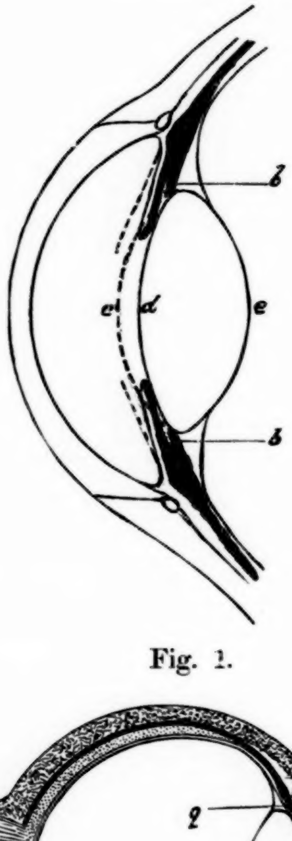


Fig. 1.

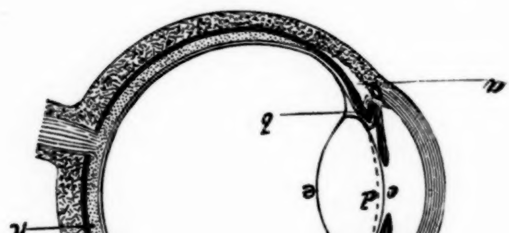

Fig. 2

once apparent, that of supplying more nourishment by the pulsations of frequent accommodation and by a careful avoidance of a fixed focus resulting from a too constant attention to any one object, either near or remote.

To make the theory clear, I present sketches with explanatory notes referring to them by letters.

In Fig. 2. the ciliary bodies are shown at a. a.: the muscle having origin its at the border of the cornea, and since action and reaction are equal, a strain on the cornea would equal that on the choroid, and would tend to flatten the cornea.

In Fig. 2. it will also be seen that the retina R. lies in front of the choroid and therefore if the choroid should be drawn forward by the ciliary muscle at the same time the cornea is drawn backward by the reacting force, it would be compressed between these two opposing forces.

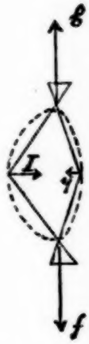


FIG. 3.

In Fig. 3 the arrows f and g show the directions of strains supposed to be exerted on the border of the capsule. Taking these as equal, in opposite directions and all in the same plane, we find by the parallelograms of forces the arrows h and i, which by their length show the ratio of forces acting in a way to flatten respectively the anterior and posterior segments of the lens. The force i, acting on the posterior segment, being several times greater than h, which acts upon the anterior segment.

In Figs. 1. and 2. b b. represent the ciliary processes or cysts (?) which by contracting on themselves inject the fluid into the lens and advance the anterior surface from d to c.

# ON THE USE OF CYLINDRICAL GLASSES IN COMPOUND ASTIGMATISM.

BY H. CULBERTSON, M. D.,
Assistant Surgeon United States Army, Retired.

The use of *positive*, in lieu of NEGATIVE, cylinders, in COMPOUND ASTIGMATISM, in proximal vision has been of practical value to me in the correction of such forms of ametropia. If, however, perfect remote vision is demanded in CO. M. ASTG, the *negative* cylinders do better. Most of such patients are better satisfied to sacrifice somewhat their *distant* vision by using *positive* cylinders, for the advantage derived from these in *proximal* vision. Such glasses are often not strong, negative D 0.25, or—D 0.5, frequently doubling distant vision. That we have a choice of cylindrics, in the correction of ametropia, is well known. Thus, in a given case of CO. H. A. = + D 1.0 Sp. $\bigcirc$ + D 0.5, axis 180°, we may employ + D 1.5 Sp. $\bigcirc$ — D 0.5 cy. axis 180°; or, + D 1.5 Sp. $\bigcirc$ + D 0.5 cy. ax 90°. I have used *these* forms and not unfrequently prefer the second to the first in near, and the former, in remote vision. Again, in a case of CO. M. A. = — D 3. 5 Sp. $\bigcirc$ — D 0.5 cy axis 90°, the correction may be = — D 4.0 Sp. $\bigcirc$ + D 0.5 cy. axis 90°; or — D 4.0 Sp. $\bigcirc$ — D 0.5 cy. axis 180°. The *former* combination gives better results in *proximal*, the latter in *remote* vision; and while *slightly* impairing the *remote*, the *proximal* vision is improved with the first formula.

To illustrate this subject Fig. 4, is necessary. In this;

Let p = Parallel rays in horizontal plane.<br>
“ $p^1$ = “ “ vertical plane.<br>
“ $p^2$ = “ “ rendered myopic in horizontal plane.<br>
“ M = Vertical section of + spheric.<br>
“ $M^1$ = Horizontal section of + spheric.<br>
“ L = Vertical “ “ — cylindric.<br>
“ $L^1$ = Horizontal “ “ — “<br>
“ c = Vertical “ “ cornea.

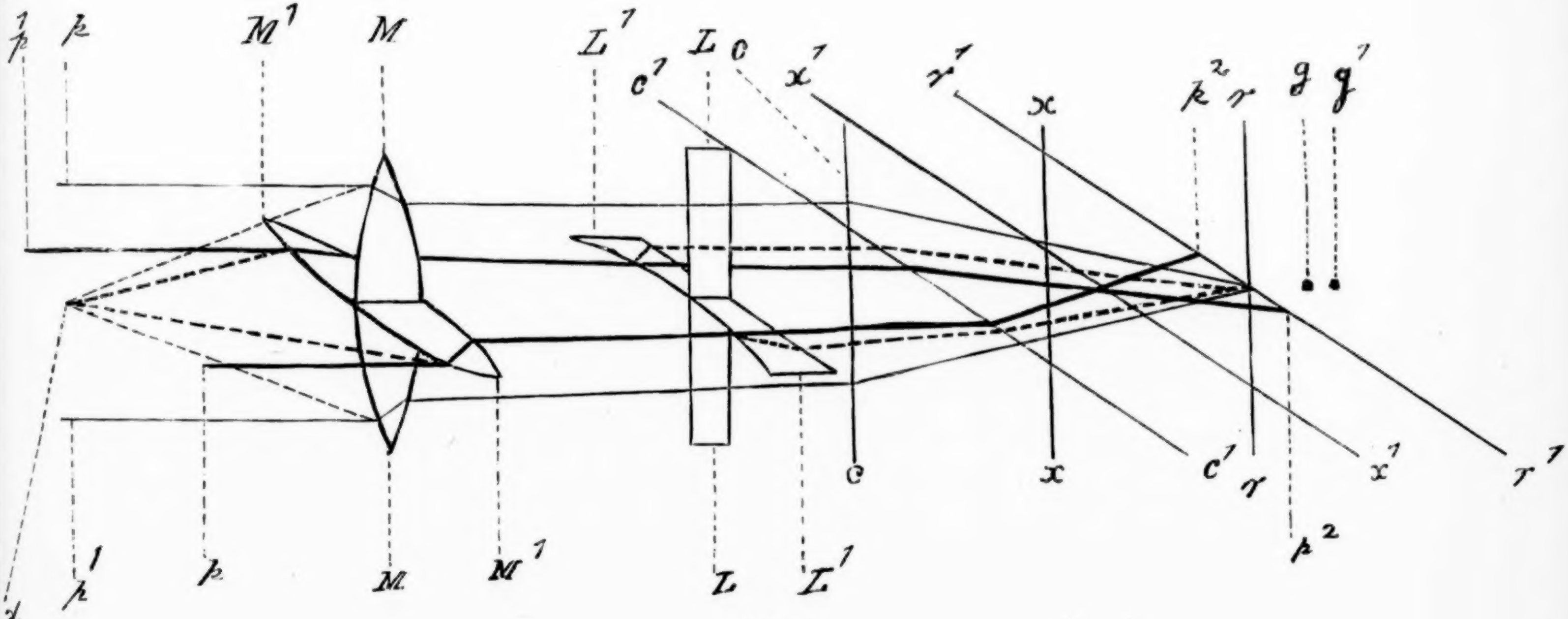


FIG. 4.

Let $c^1$ = Horizontal section of cornea.
" $x$ = Myopic focus in vertical plane.
" $x^1$ = " " " horizontal plane.
" $r$ = Vertical section retina.
" $r_1$ = Horizontal " "
" $g$ = Hypermetropic focus in vertical plane.
" $g^1$ = " " " horizontal "
" $A$ = Accommodation in vertical "
" $A^1$ = " " horizontal "
" $d$ = Position of object in near vision.

These several equivalents *without* exponents, refer to the *vertical*, those *with*, to the *horizontal* plane.

A case of CO. H. ASTG. is assumed, = + D 3.0 Sp. ⌣ + D. 1.0 cy. axis 180°. In this example there is H. = + D 4.0 in the vertical plane, and H = +D 3.0, in all the other meridians of the eye.

In this case also, *without correction*, $p^1$, tends to focus at $g^1$, and p at g. If $M^1$ = + D 4.0 be applied, $p^1$, will be refracted in the heavy lines and reach $p^2$, and artificial myopia be induced in the *horizontal* plane = — D 1.0; because there are but = D 3.0 H, in said plane, and the + D 4.0 refracts = + D 4.0. Applying now M = + D 4.0, p will be refracted and reach the retina r, in focus, for the H. in this plane (the vertical) is = + D 4.0. If now $L^1$ = — D 1.0, be applied $p^1$, will be refracted, as represented in the heavy dotted lines, by $L^1$, and $p^2$ will become $r^1$. As *this* section of the *cylinder* L does not refract, the rays in the *horizontal* and *vertical* planes will now be upon the retina r $r^1$, and VISION REMOTUM will be distinct.

As all the foci of the meridians of the eye are now upon the retina r $r^1$ in *remote* vision, if the object be approached to the eye, as represented at d, the accommodation A $A^1$ will be uniform in the *several* planes, the foci will be maintained at r $r^1$, and VISION PROXIMUM distinct in all the meridians of the eye.

If, in *proximal vision*, + D 4.0 Sp. ⌣ + D 1.0 cy. axis 180° be applied, and the *negative cylinder* removed, $p^1$ will, from the refraction of $M^1$ = + D 4.0, become $p^2$, (for there is only = + D 3.0 of H in this plane, which $M^1$ overcorrects to + D 1.0) and *artificial myopia* is induced in this plane = — D 1.0. This

+ cylinder does *not* refract in the *horizontal* plane. Now applying M and L = + D 4.0 Sp. ⊂ + D 1.0 cy. axis 180°, r will become $p^2$, or the H = + D 4.0 of the *vertical* plane will be corrected by M; and L now = + D 1.0 cy. will induce an *artificial myopia* = — D 1.0 in the VERTICAL plane, and *all the meridians* will be myopic. If now d be approximated to the eye, the foci will be maintained upon the retina r $r^1$ by A $A^1$, *uniformly*, and the image will be *larger* and *proximal* vision more distinct as the object is held somewhat nearer the eye.

As is well known, this case could have been corrected by applying + D 3.0 Sp. ⊂ + D 1.0 cy. axis 180°. But the foregoing plan has its advantages in distant, and in some cases for proximal, vision. A case is given, selected from a number appropriate, which could be cited.

Miss M. McC., æt. 31 years, a school teacher, has V. R. and L. = D $\frac{6.0}{6.0}$, and D $\frac{0.6}{0.25}$ Snellen. Without duboisine, and with + D 0. 5 Sp. ⊂ — D 0.25 cy. axis 170°, V. R. = D $\frac{6.0}{6.0}$ S.; and with + D 0.75 Sp. ⊂ — D 0.5 cy., ax. 20°, V. L. = D $\frac{6.0}{6.0}$ Snellen. Under duboisine, with + D 1.0 Sp. ⊂ — D 0.5 cy. ax. 170°, V. R. = D $\frac{6.0}{6.0}$ S.; and with + D 1.25 Sp. ⊂ — D 0.5 cy., ax. 20°, V. L. = D$\frac{6.0}{5.0}$; and $V^2$ = D $\frac{6.0}{5.0}$, and D $\frac{0.6}{0.25}$ Snellen. She preferred the *negative* cylinders as *these* rendered better *remote*, and still gave fair *near* vision in her duties as a teacher.

In cases of COMPOUND MYOPIC ASTIGMATISM, the principle of using cylinders, as above stated, has also been useful in such examples of ametropia. This subject may be illustrated by Fig 5, in which,

Let p = Parallel rays in vertical plane.
" $p^1$ = " " " horizontal "
" $p^2$ = Focus H " " vertical "
" M = Vertical section negative spheric.
" $M^1$ = Horizontal " " "
" L = Vertical " positive cylindric.
" $L^1$ = Horizontal " " "
" c = Vertical " cornea.
" $c^1$ = Horizontal " "
" x = Vertical myopic focus.

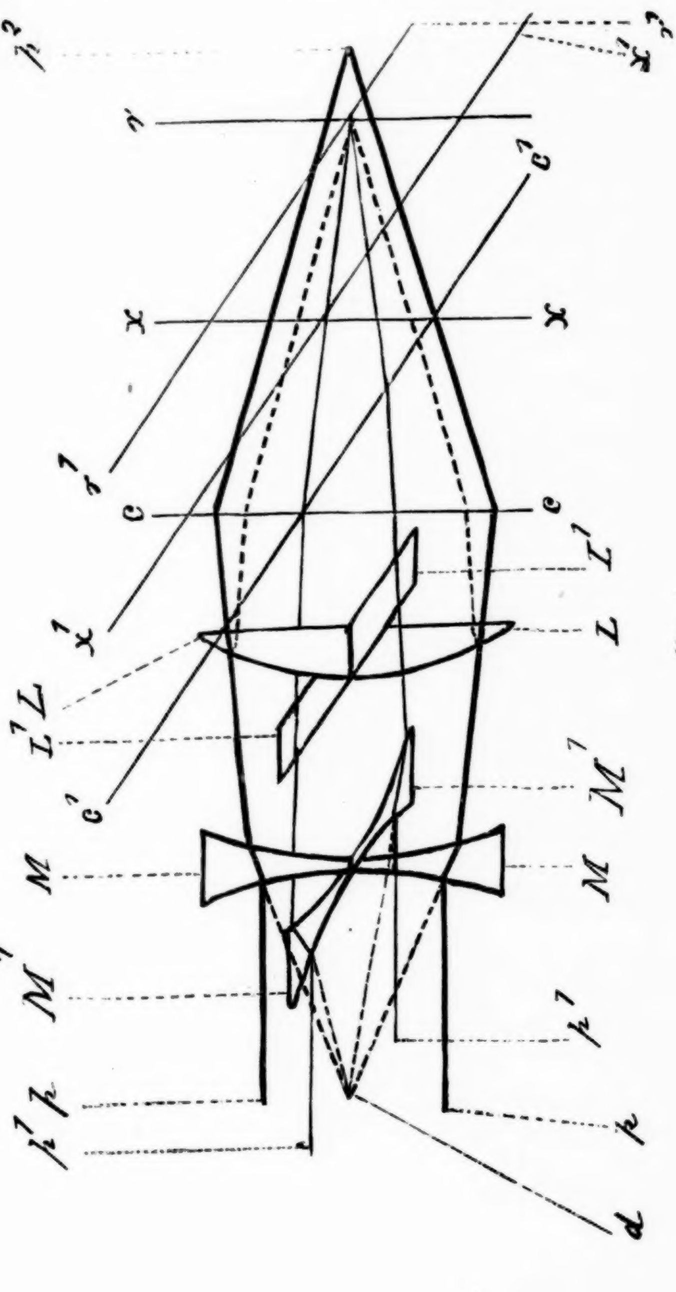

FIG. 5.

Let $x^1$ = Horizontal myopic focus.
" r = Vertical section retina.
" $r^1$ = Horizontal " "
" d = Position of object in near vision.
" A = Accommodation in vertical plane.
" $A^1$ = " " horizontal "

These references *without* exponents (excepting $p^2$) refer to the *vertical*, and those *with* exponents, to the *horizontal* meridians.

Suppose a case of this form of ametropia = — D 2.0 Sp. ⊃ — D 1.0 cy. axis 180°; in which there is a myopia — D 2.0 in *all* the meridians, and = — D 3.0 in the *horizontal* plane. In such a case, without the correction of glasses, parallel rays p $p^1$ will be refracted excessively and reach r $r^1$ in circles of diffusion. But when M = — D 3.0 Sp. is applied in the *vertical* plane, the heavy parallel rays, p, will tend to focus at $p^2$, from the fact that there are *but* = — D 2.0 OF MYOPIA in this plane, and M is = — D 3.0 Sp., and hence results, in this plane, ARTIFICIAL H = + D 1.0. If now $M^1$ = — D 3.0 Sp. be applied in the *horizontal* plane of the eye, and in which plane there is myopia = — D 3.0 $M^1$ will correct *this meridian*, and $p^1$ will become $r^1$, and the focus of this plane be upon the retina. If now the *positive* cylinder be applied = + D 1.0 cy. axis 180° (and refracting only in the vertical plane)L will correct the *artificial* H=+D 1.0 cy in the *vertical plane*, as represented by the heavy dotted lines, and p will be rendered diverging by M, and less by L, and will be brought to a focus at r. As the rays are in focus upon the retina at r $r^1$ in all the meridians, *remote vision* will be distinct

If now d be approached to the eye, the foci being upon the retina in all the meridians, A $A^1$ will maintain them upon this membrane uniformly, and PROXIMAL VISION will be distinct.

If now it is desired to apply — D 3.0 Sp. ⊃ — 1.0 cy. axis 90°, then the *new* L will be *non-refracting* in the *vertical* plane; but the new $L^1$ will refract = — D 1.0 in the *horizontal* plane. It follows that $M^1$ = — D 3.0 Sp., being applied and acting on the *horizontal* plane, and *also* $L^1$ = — D 1.0; and as there is but = — D 3.0 of myopia in the eye, in *said plane*, that there will be induced in it *artificial* H = + D 1.0. At the same time, in the *vertical* plane of the eye, as there is but = — D 2.0 of my-

opia, and as M refracts = — D 3.0 Sp. in *said meridian*, there will result in it *artificial* H = + D 1.0; and now the *horizontal* and *vertical* meridians are hyperopic = + D 1.0 and *remote vision* will require accommodation. As the meridians are over-corrected uniformly, and the foci upon the retina r r', if the object be approached to d, A A' will act *uniformly* upon the rays in all the meridians, and the foci be maintained upon the retina. It is evident that from this combination A A' will be increased = + D 1.0 in *proximal* vision and to the same degree in *remote* vision. Such formulæ might be useful in compelling the patient to remove the near point in *proximal* vision, thus diminishing the diverging of the incident rays, and so be useful; but I have not used this *negative formula*, and am unable to speak practically upon this point as to the effect in *proximal vision*.

As is well known, this form of ametropia could be corrected with — D 2.0 Sp. $\asymp$ — D 1.0 cy., axis 90°.

A case is given from a number which might be reported:

Mr. H. L., æt. 39 years, an architect, has R. E. V = D $\frac{5.0}{6.0}$ and D $\frac{0.5}{0.15}$ S.; L. E. V. = $\frac{5.0}{15.0}$ and D $\frac{0.8}{0.15}$ Snellen. With — D 1.5 Sp. $\asymp$ + D 0.75 cy, axis 180°, V. R. = D $\frac{4.0}{5.0}$, and with — D 1.5 Sp. $\asymp$ + D 0.75 cy., axis 180°, V. L. = $\frac{4.0}{5.0}$; and $V^2$ = D $\frac{5.0}{4.0}$ and D $\frac{0.6}{0.28}$ Snellen. These glasses are still satisfactory after eighteen months' use. In this case an effort was made to employ — D 0.75 Sp. $\asymp$ — D 0.75 cy, axis 90°, R. E. and — D 1.0 Sp. $\asymp$ — D 0.5 cy., axis 90°, L. E.; and with these *remote* vision = D $\frac{5.0}{5.0}$ Snellen, obtained, and objects were seen more distinctly in the *distance*; but in *proximal vision*, sight = D $\frac{0.6}{0.40}$ Snellen resulted, and was not so distinct as with the + cylinders.

# A CASE OF ACUTE GLAUCOMA OF ONE EYE CURED TEMPORARILY BY ESERINE; RELAPSE; IRIDECTOMY.

BY DAVID WEBSTER, M. D., NEW YORK.

March 12, 1878, Mrs. Mary S., aged 43, a domestic, presented herself at the eye clinic at the college of Physicians and Surgeons on account of pain in and about her right eye, with great blurring of sight, which, she said, had been getting worse and worse for several weeks.

Upon testing her vision we found R. V. = $\frac{8}{CC}$; no improvement with glasses. L. V. = $\frac{20}{XX}$; Hm. $\frac{1}{60}$.

The left eye was normal in every respect, and remained so while under observation.

The right eye showed much ciliary injection, increased tension and mydriasis, no mydriatic having been used. There was so much cloudiness of the media as to prevent a good examination of the fundus, but the optic disk could be seen well enough to permit the breaking of the blood vessels in passing over the edge of an excavation occupying the whole papilla to be observed. The patient was directed to drop into the eye a drop or two of a one per cent solution of eserine once a day.

March 26. R. V. = $\frac{20}{C}$. The patient says that she has had no neuralgia in the eye since she commenced using the drops. She was ordered to use a two-grain solution of eserine twice a day.

May 15, 1878. The media are perfectly clear, but the tension is still somewhat increased and the pupil slightly dilated. There is marked cupping of the disk and slight arterial pulsation. Vision = $\frac{20}{XX}$ with + $\frac{1}{12}$.

June 26. The eye is in precisely the same condition as at her last visit.

Sept. 17. Vision = $\frac{20}{LXX}$ without a glass, but raised to $\frac{20}{C}$ with a

$+ \frac{1}{10}$. To use a one per cent solution of eserine three times a day.

Sept. 20. V. = $\frac{20}{L}$ with $+ \frac{1}{20}$. Limitation of infero-nasal portion of visual field.

Sept. 27. V. = $\frac{20}{L}$ with $+ \frac{1}{18}$. Tension still increased, arterial pulsation, increasing excavation of the papilla, some ciliary injection and very little pain.

The patient now consented to an iridectomy, an operation which had long since been advised, but which she had always postponed on account of circumstances over which she had no control.

Sept. 28. Iridectomy upward, under ether.

Oct. 2. V. = $\frac{20}{L}$ with $+ \frac{1}{18}$.

Oct. 26. V. = $\frac{20}{L}$ with $+ \frac{1}{24}$.

It will be remarked that the glaucomatous eye accepted convex glasses of very variable strengths at the different testings. The strongest convex glass with which the patient saw as well as with any other was always the one selected. This variation in the amount of hypermetropia was probably due in part to the influence of increased and varying intraocular pressure upon the indices of refraction of the dioptric media, and in part to the eye, having been more or less under the influence of eserine at most of the examinations.

The eserine was undoubtedly of temporary benefit in this case, but the patient put off the operation of iridectomy too long, so that after the operation the vision never rose above—$\frac{20}{L}$. In all probability if the operation had been performed when we first saw her, there would have been a permanent restoration of sight to $\frac{20}{XX}$.

## CORRESPONDENCE.

LITTLE ROCK, ARK., Dec. 17, 1885.

*Dear Dr. Alt:*—Dr. Fox's formula seems to me a very strange one. I cannot well conceive of two axes of like excessive or deficient refraction in the same cornea, crossing each other at any other angle than 90°, when, if they are equal, it becomes a simple spherical error, and if unequal, compound astigmatism. If the lens and cornea in the same eye were each to take on like regular astigmatism, their axes might intersect at any angle and produce such a condition as Dr. Fox and Dr. Little mention; but in Dr. Fox's case there was aphakia.

Dr. Little, in speaking of Mr. Borsch being able to grind a sphere and double cylinder in the same lens, says: "Prior to this time I had been unable to provide cases of mixed astigmatism requiring presbyopic correction with a spectacle combining both corrections." Unless the lens takes on regular astigmatism also with presbyopia I cannot see the cause of this. I have certainly had no trouble in obtaining a formula for a sphero-cylinder to meet increasing presbyopia. I never prescribe cross cylinders. As to Dr. Waldmann's correcting a + 3 D cy. ax. 180° $\bigcirc$ + 2 D cy. ax. 50° with a — 1 D s $\bigcirc$ — 3 D cy. ax. 15°, I think he is simply mistaken. The correction is only approximate, and it is a mathèmatical and experimental error.

Very respectfully,

T. E. MURRELL.